City of Baltimore

Historic Structures in a Changing Climate

The Maryland Historical Trust

May 25, 2017

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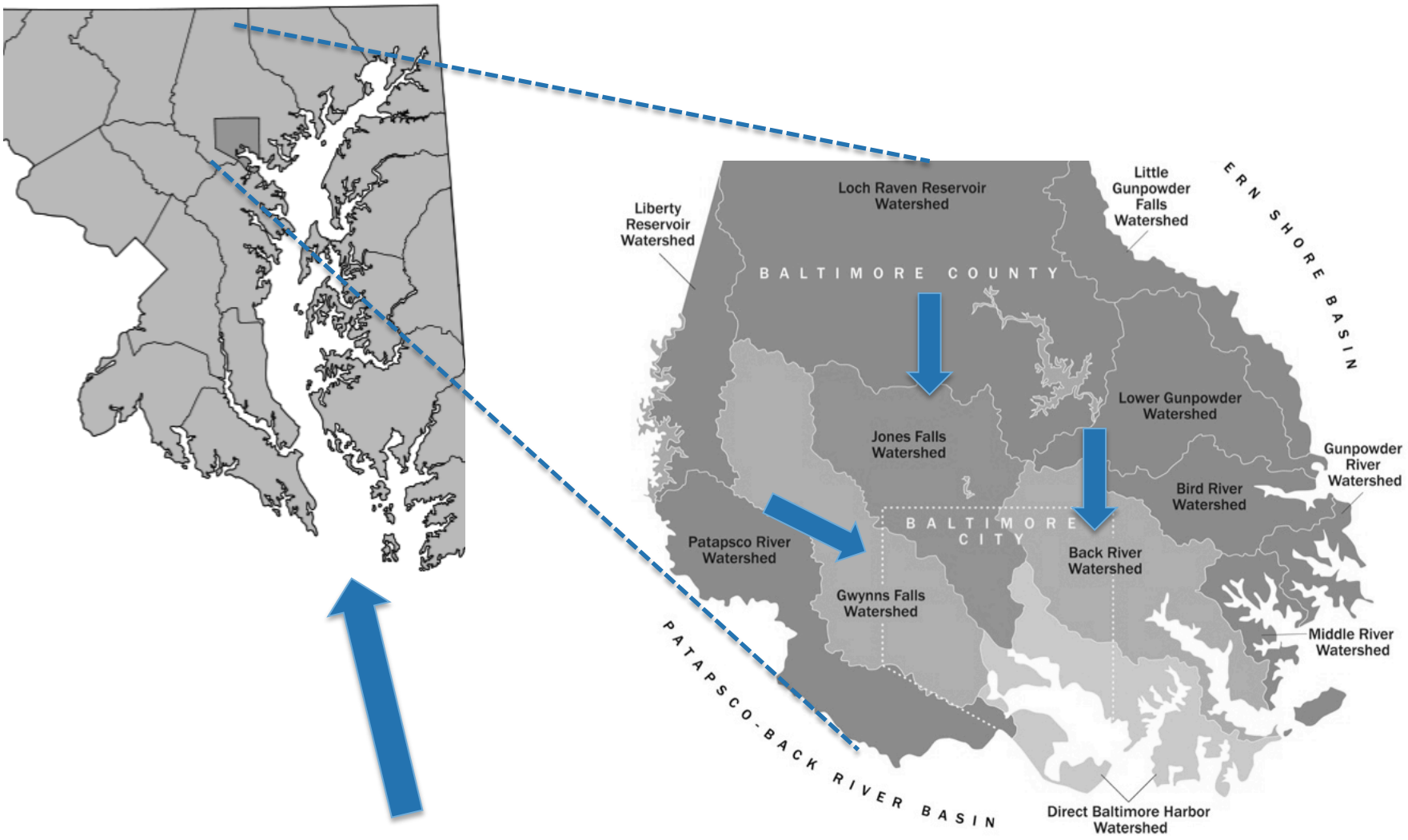
City of Baltimore

Department of Planning

Overview

- Context
- Historical Impacts
- Weather & Climate
- Historic Structures
- Planning
- Implementation
- Integration

Relationship with Water



Definitions

Hazard Mitigation

Hazard Mitigation is action taken to reduce or eliminate long-term risks to people and their property from hazards.

Climate Adaptation

Climate Adaptation refers to changes made to better respond to new climate conditions, thereby reducing harm and taking advantage of opportunities.

Baltimore's Unique Approach

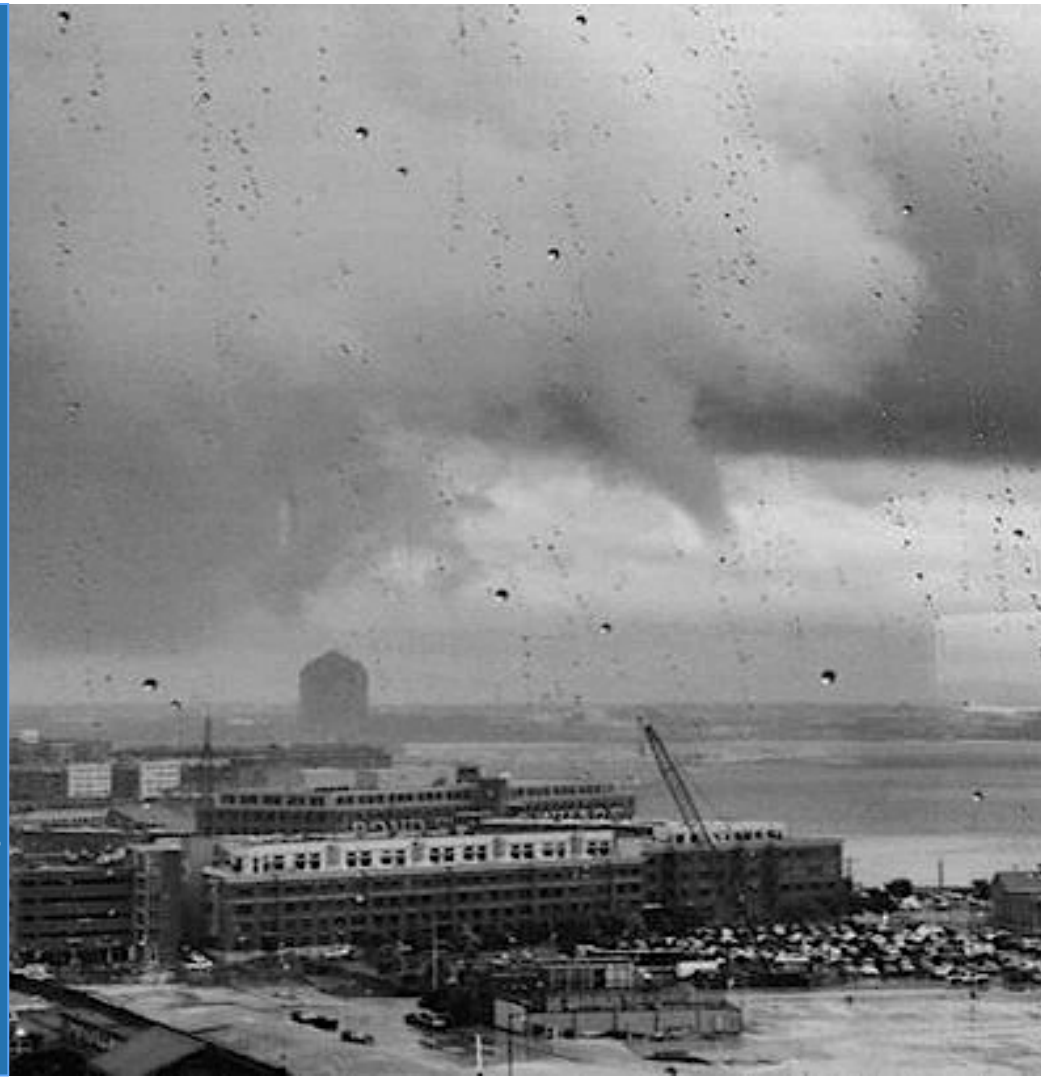
All Hazard Mitigation Plan
(current and historical hazards)

Climate Adaptation Plan
(new & predicted climate conditions)

Resilience

Definition of Resilience

The ability of our community to anticipate, accommodate, and **positively adapt to or thrive** amidst changing climate conditions or hazard events and **enhance quality of life**, reliable systems, economic vitality, & conservation of resources for present & future generations.



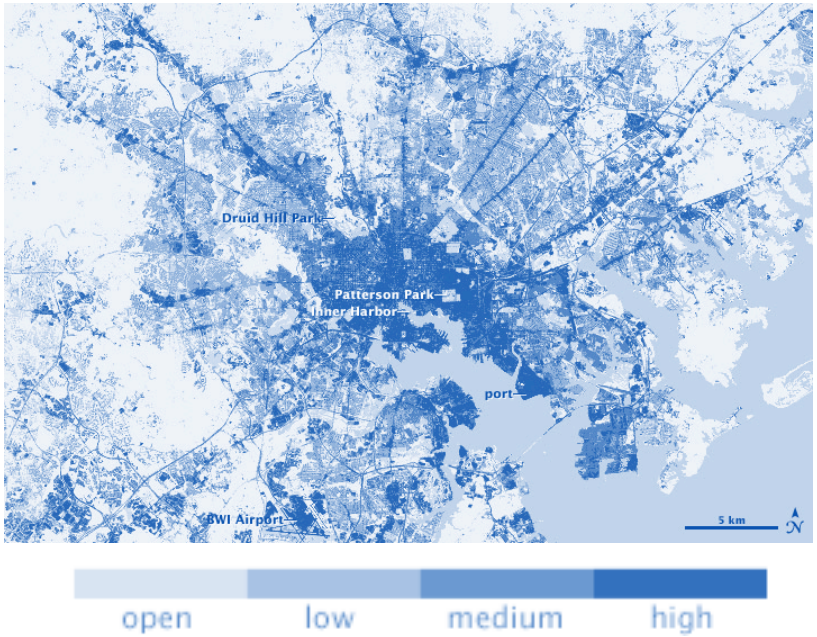
Shocks and Stressors

SHOCKS	STRESSORS
Typically considered single event disasters	Factors that pressure the City on a daily or reoccurring basis
Fires	Endemic Violence
Hurricanes	High Unemployment
Earthquakes	Endemic Drug Use
Floods	Poverty

Focus on both shocks and stresses to enhance community adaptive capacity and resilience, especially in vulnerable areas

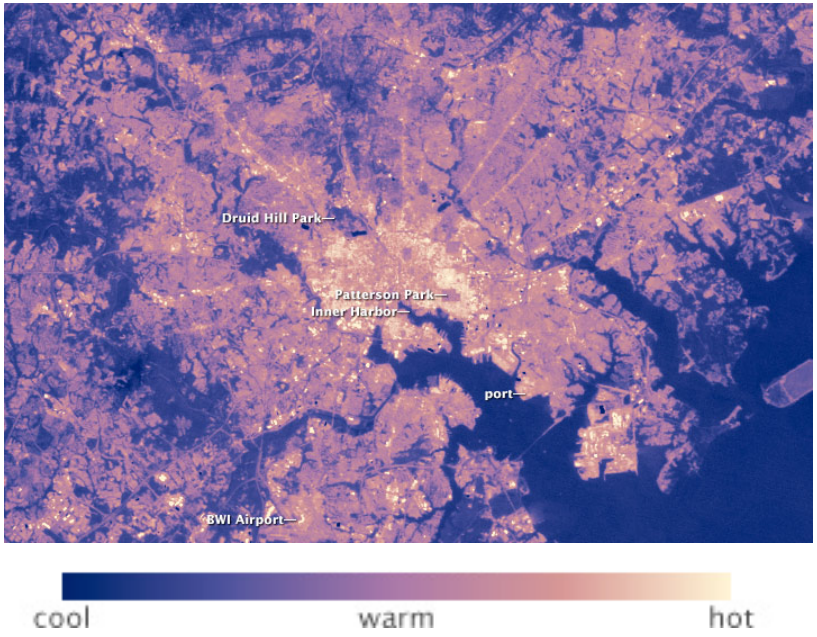

Altec
STOP

Climate Variability Extreme Heat



DEVELOPED LAND

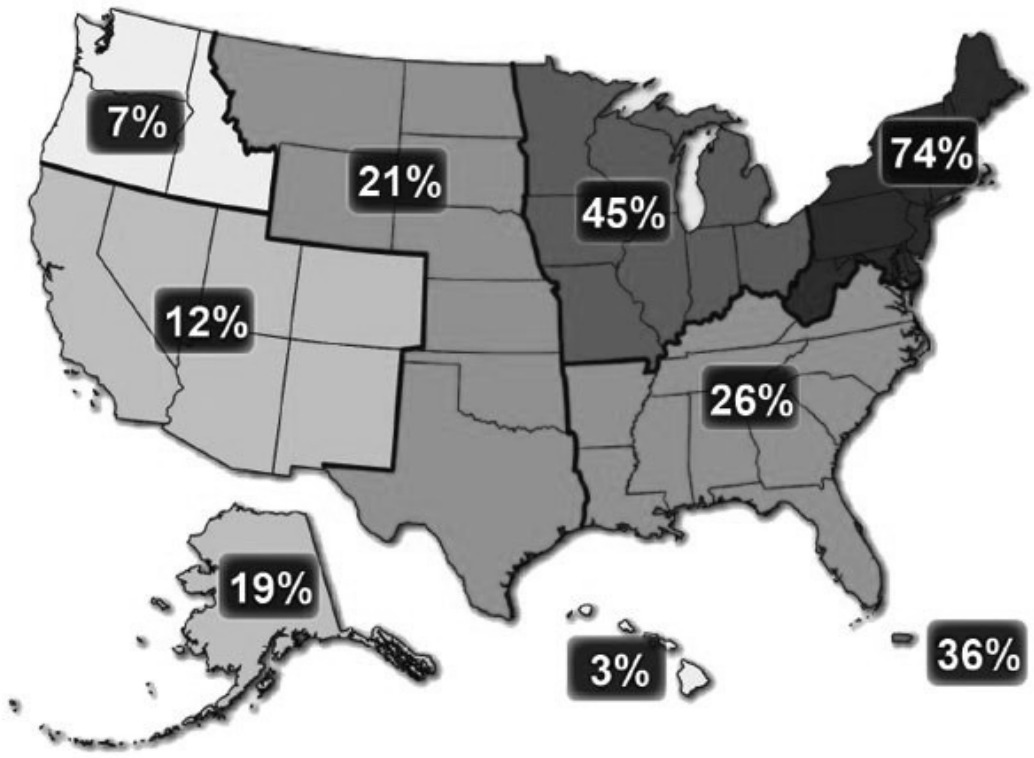
BALTIMORE HAS A HIGH AMOUNT OF IMPERVIOUS SURFACE WHICH LEADS TO INCREASED URBAN HEAT ISLAND EFFECT



LAND SURFACE TEMPERATURE

THE NUMBER OF DAYS WITH AIR TEMPERATURES EXCEEDING 90 F IS PROJECTED TO DOUBLE (AND COULD EVEN TRIPLE) BY THE END OF THE CENTURY.

Climate Variability Precipitation



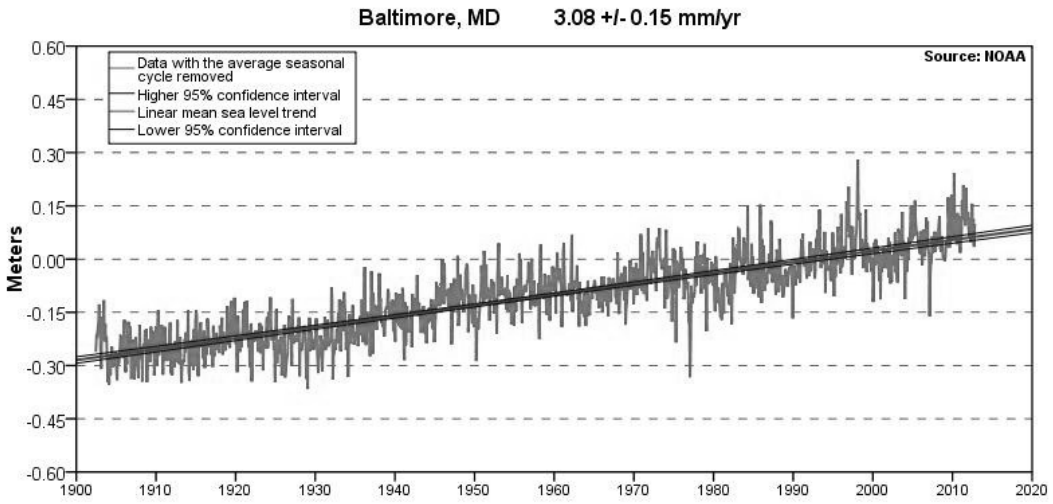
National Climate Assessment

SNOWMAGEDDON
FEBRUARY 5-6, 2010

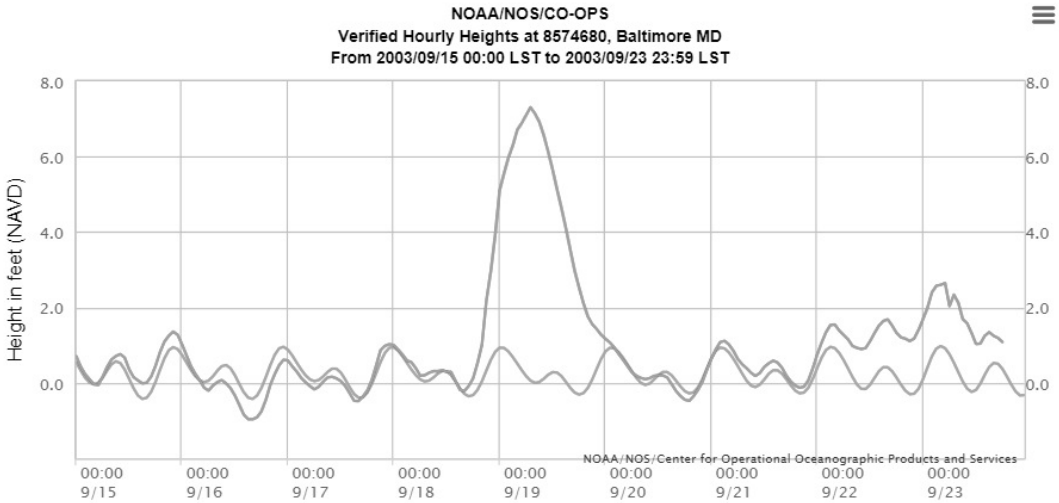
FLASH FLOOD
APRIL 30, 2014

FLASH FLOOD
JULY 30, 2016

Climate Variability SLR & Storm Surge



Increase of 30 centimeters over last 100 years.
Projected another 30-90 centimeters in next 30 years



The greatest threat to life actually comes from the storm surge associated with storms

Climate Variability Coastal Storms

There has been a substantial increase in hurricane activity in the Atlantic since the 1970's.

Recent Tropical Storms/ Hurricanes impacting Baltimore:

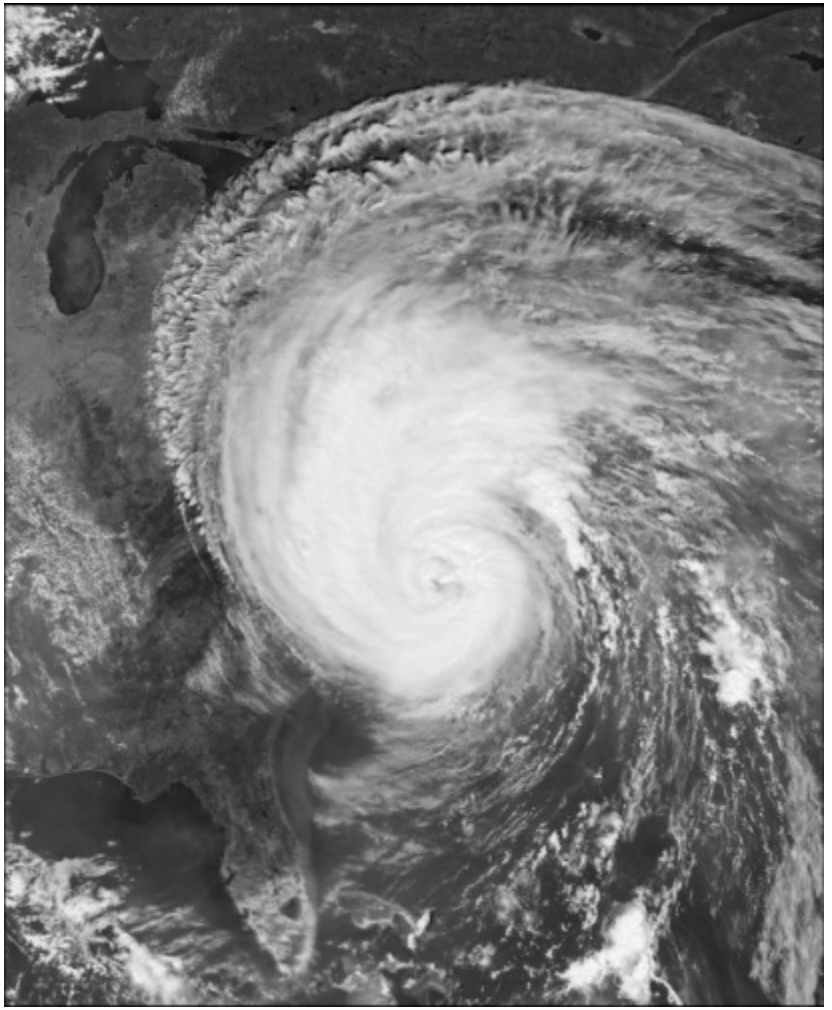
2013 Hurricane Sandy

2011 Tropical Storm Lee

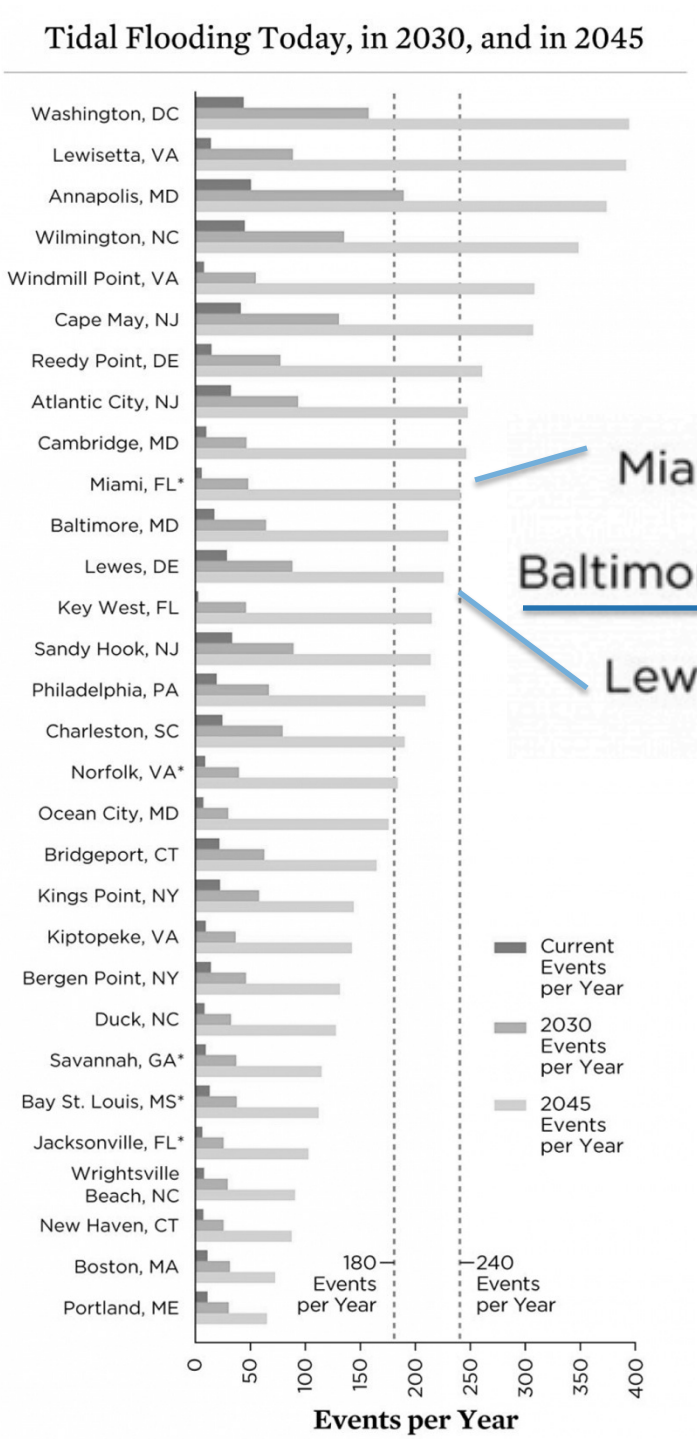
2011 Hurricane Irene

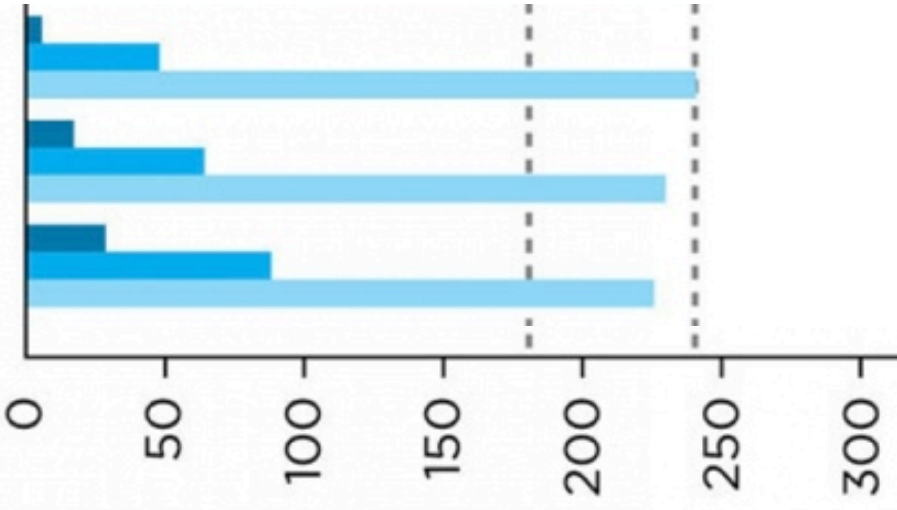
2006 Tropical Storm Ernesto

2003 Hurricane Isabel



Tidal Flooding





Union of Concerned Scientists, 2014

Future Impacts

Coastal Storms	**more severe**
Floods	**more extensive**
Severe Thunderstorms	**more severe**
Wind	**increase intensity**
Winter Storms	**less snow, more flooding**
Extreme Heat/Drought	**more severe and intense**
Sea Level Rise	**increased threat**
Air Quality	**lower quality and increase risk**

Historic Structures in Floodplain

80,000

Number of Historic Structures in the Regulated Floodplain

Est. 8,000

Number of Historic Structures in Baltimore City

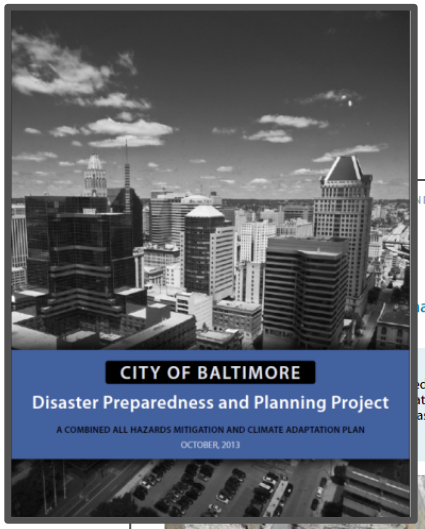
- Fells Point
- Dickeyville
- Mill Valley
- Federal Hill
- Locust Point

Historic & Climate Collaboration

PLANS & DOCS	PROJECTS
Disaster Preparedness Plan	Community Rating System
CHAP Design Guidelines	Historic Mapping Project
Flood Design Manual	Silver Jackets- Retrofits
Floodplain Code	Commercial Retrofits

Focus on maintaining the historical integrity of the building while also considering current and future climate impacts

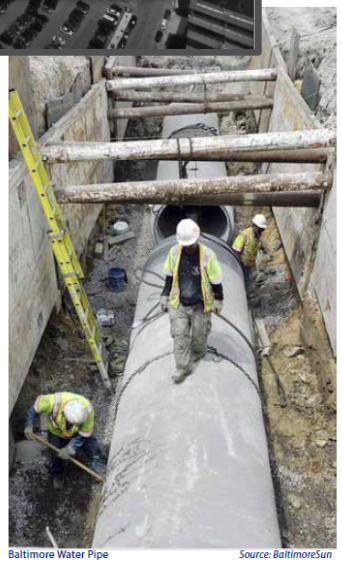
Primary Guiding Document



Adopted unanimously in October, 2013 with section on Historical Buildings & Cultural Assets

…at evaluates and improves all pipes' ability to withstand

…d and in need of upgrades. It is important to build extreme weather …ter and wastewater systems by using both adaptation and mitigation …astructural upgrades must be made to reduce loss of water supply



Baltimore Water Pipe *Source: BaltimoreSun*

1. Replace old and malfunctioning pipes with new pipes or retrofit existing pipes with new lining

   Pipes that have already begun experiencing problems, or older pipes which are more vulnerable to the impacts of hazards, should be upgraded using the best available technology.

2. Evaluate and utilize new technology that allows for greater flexibility in pipes as they are replaced

   It is essential to prepare for future changes in hazard events and proactively upgrade pipe systems to prevent cracking and bursting.

IMPLEMENTATION GUIDELINES	
Lead Agency	DPW
Stakeholders	DOT, DPW, Water and Wastewater Utilities
Alignment with Goals	Goal 3
Connection with Existing Efforts	CAP; CRS; MD DNR; ESF-3; ESF-4
Timeframe	

STORMWATER

IN-16 Enhance and expand stormwater infrastructure and systems

Future changes in precipitation frequency and intensity may require reconsideration of the design of existing stormwater infrastructure systems.

Increase resiliency and disaster prevention measures related to stormwater systems by enhancing drainage systems in stream corridors and improving and repairing stormwater conveyance popes and outfalls.

1. Implement the requirements of Baltimore's MS4 (separate stormwater and sewer system) permit (S)

   The City of Baltimore operates under a Municipal Separate Stormwater and Sewer System (MS4) permit, which protects water-quality and requires that Baltimore prevents pollution as much as possible. It is critical that the requirements of these permits are fully met.

2. Prioritize storm drain upgrades and replacement in areas with reoccurring flooding (S)

   While proximity to a floodplain or floodway can increase vulnerability to flooding, certain measures can reduce this vulnerability. Inadequate or older pipes, which cannot accommodate the excessive amounts of stormwater, should be upgraded so as to handle extreme rainfall and storm surge events.

3. Install backflow-prevention devices or other appropriate technology along waterfront to reduce flood risk (M-L)

   Backflow-prevention devices are used to ensure that water does not flow back through drainage infrastructure. Through the installation of backflow-prevention devices, the City can improve the performance of the drainage network and prevent risk of flooding impact along the waterfront.

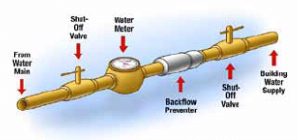
4. Preserve and protect natural drainage corridors (S)

   It is important to utilize natural drainage corridors and green infrastructure to capture more stormwater runoff and enhance the ability of the existing infrastructure to cope with environmental changes.

5. Review and revise storm drain design on a continuous basis, to accommodate projected changes in intense rainfall (O)

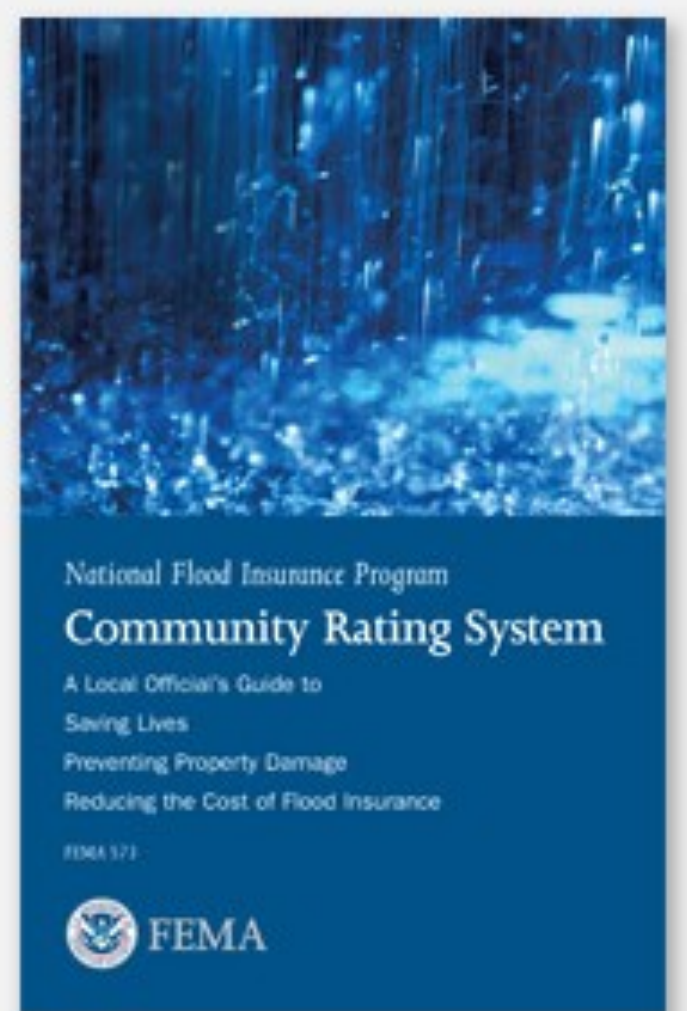
   The City's storm drains will require continual revision to incorporate new and projected changes in intense rainfall. This will ensure that the storm drains maintain adequate capacity.

IMPLEMENTATION GUIDELINES	
Lead Agency	DPW
Stakeholders	Community Groups, DOT, DPW, MOEM, MDNR, NGOs, Private Developers, Stormwater Utility
Alignment with Goals	Goals 1, 3, and 6
Connection with Existing Efforts	CRS; MD DNR
Timeframe	



Backflow Preventer *Source: DemarPlumbingNYC*

Community Rating System



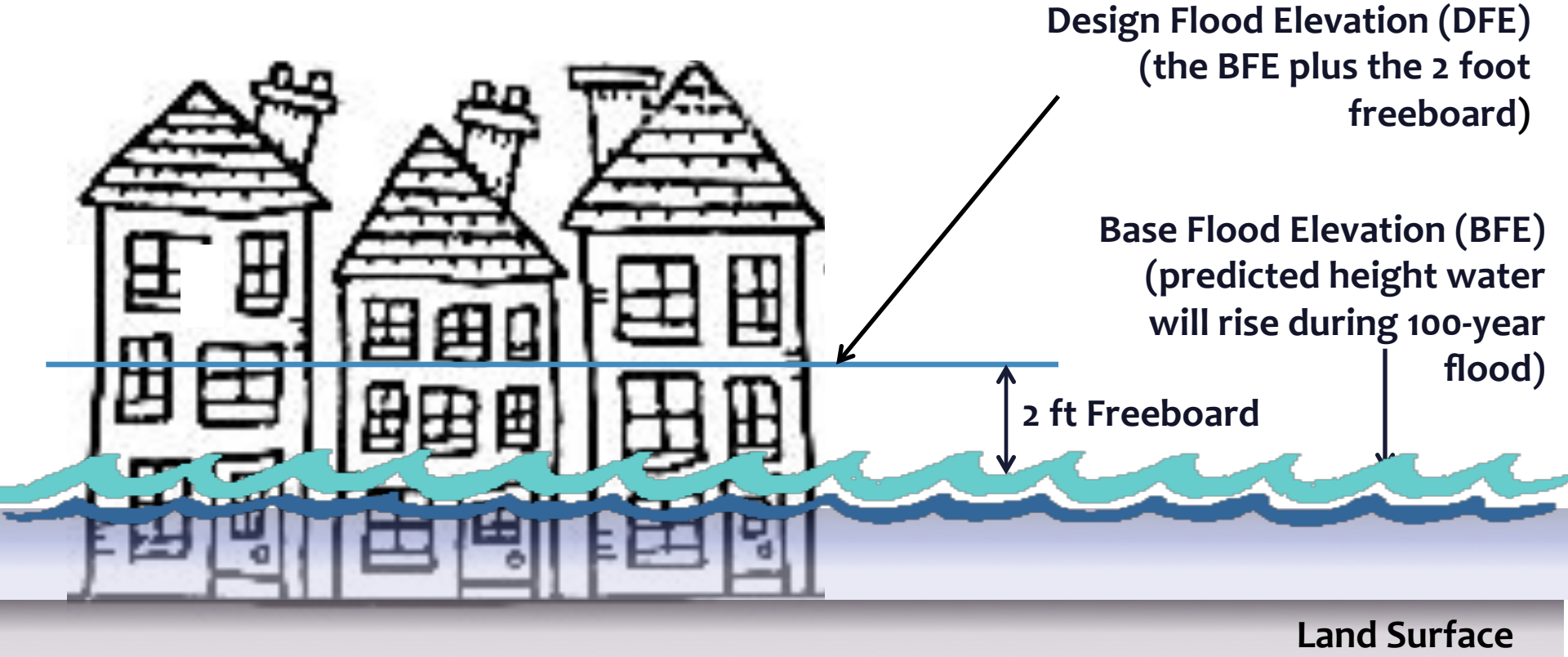
Voluntary incentive program that recognizes floodplain management activities that exceed the minimum NFIP requirements.

Baltimore is a **CRS Class 5**

Leads to reduced flood insurance rates to reflect the reduced flood risk and reduces flood damage to insurable property.

Implementation Example

Higher Regulatory Standards



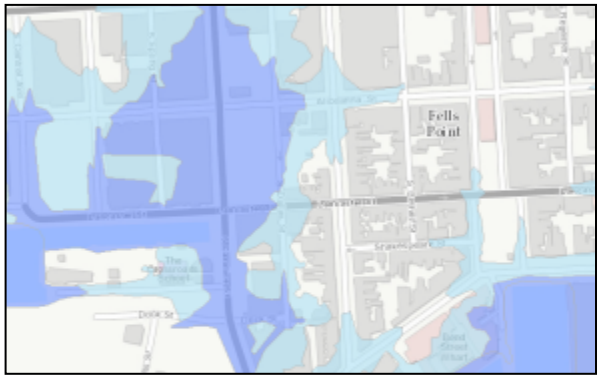
Higher Regulatory Standards

- **The City of Baltimore regulates to the height and extent of the 500-year flood in tidal areas**

Height

500

Both 100 and 500



Extent

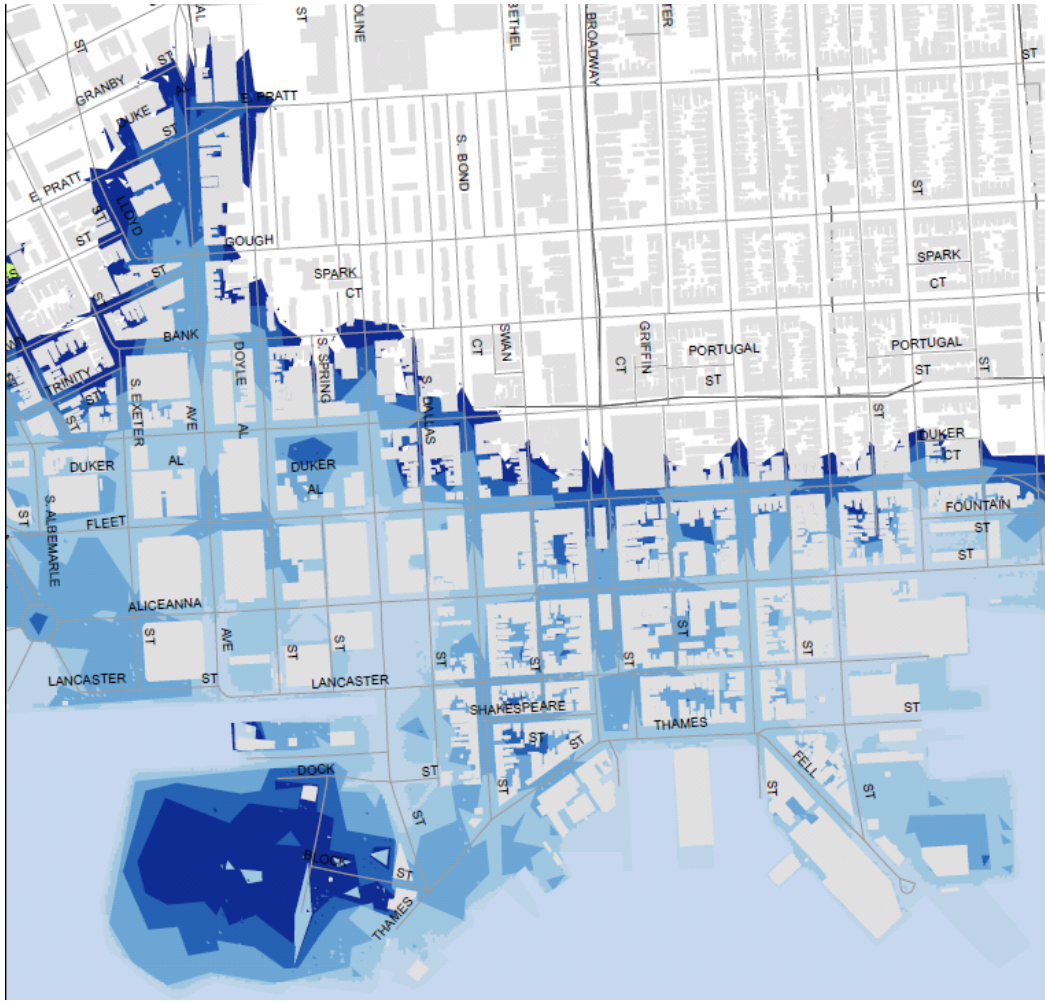
In non-tidal areas, the City regulates to the height of the 100-year flood and to the extent of the 500-year flood

100

Both 100 and 500

Flood Resilience Area

- In the Tidal Floodplain
- Regulate to the height of the 500-year flood
- Regulate to the extent of the 500-year flood
- Utilize ASCE-24 construction standards which creates higher standards based on building categories (critical facilities)



Stormwater & Outfalls

Higher Regulatory Standards

- Flood Elevation
- Zoning and Access
- Critical and Structural Systems (Category IV buildings)

300 Series: Public Engagement







Implementation Examples & Challenges

Issues & Challenges

- Pressure from development community to redevelop floodprone buildings
- Residential floodproofing not an option (large # of historic residential structures that cannot be elevated)
- Flood maps not accurately reflecting the historic or current flooding conditions
- Floodproofing techniques and massive human error with flood gates and heeding warnings


MEADOW MILL
NO TRUCKS
9'-6" CLEARANCE
NO TRUCKS

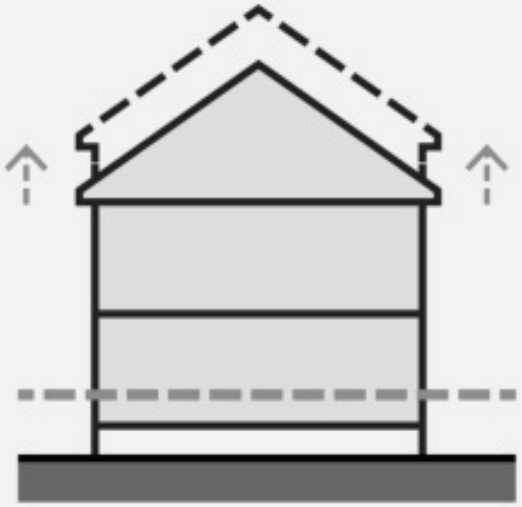

418-385-1234
WHOLE FOODS


nepenthe
homebrew


CITY PIER
BROADWAY
© M. Druckenbrod 2016

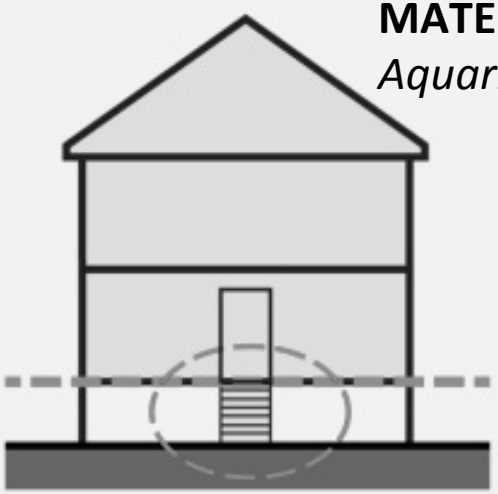
Strategies Moving Forward

- CHAP Design Guidelines
- Riverine Mapping Project
- Flood Code Update and ASCE
- Community Rating System re-certification
- Flood Trainings

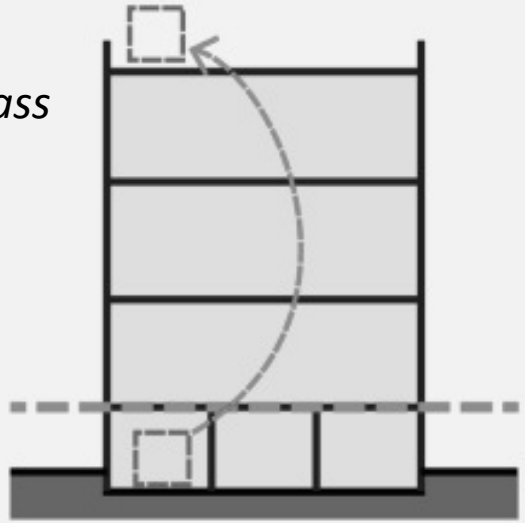


HEIGHT
must recognize elevation requirements in flood zones

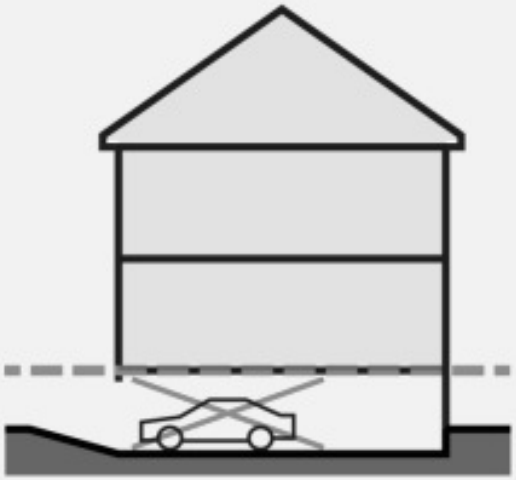
MATERIALS
Aquarium glass



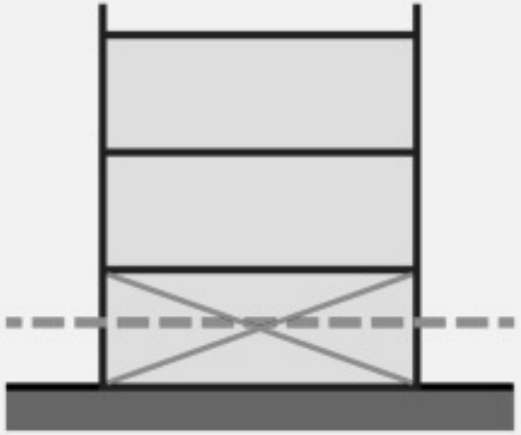
ACCESS
need for stairs or ramps requires imaginative solutions



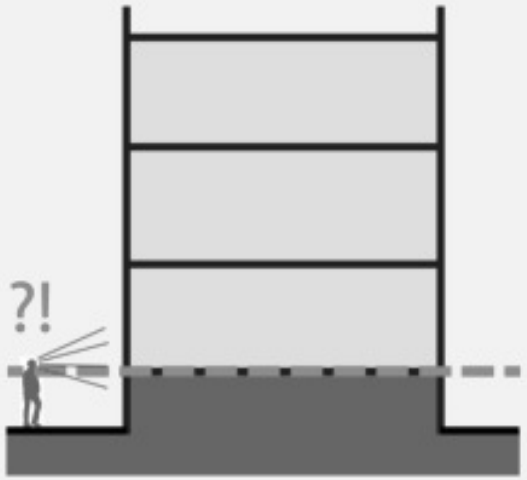
MECHANICAL SYSTEMS
must allow relocation out of flood-prone areas



PARKING
may not be possible below ground



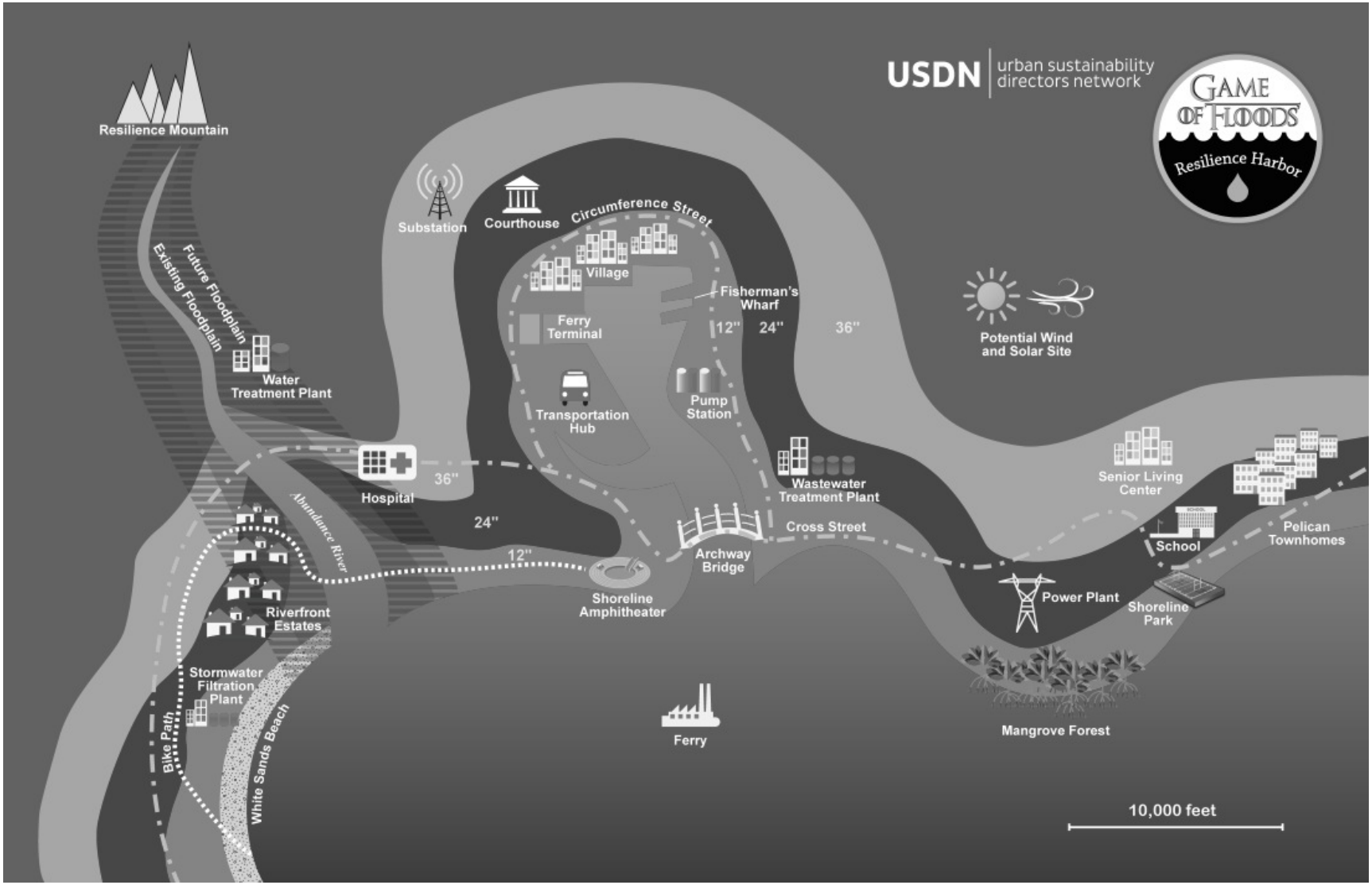
GROUND FLOOR USE
buildings may be allowed only limited use of ground floors



STREETSCAPE
limit negative effect of blank walls on streetscape

Removing Human Error

Training for Flooding- Games



Training for Flooding- Games

Team Scenario 1

Planning Horizon: 2050
Sea Level Rise: Mid range (12" by 2050)
Precipitation: 20% increase in precipitation intensity

Town History:
Originally settled by longline fisherman in the 1890s, the area became heavily farmed in the 1930s, and transitioned to a resort community during the economic boom of the 1980s. The town's economy is now based on a mix of technology-related industry, tourism, fishing, and agriculture.

Current Resident Population = 225,000

City Planning and Sustainability

Role: City Planner and Sustainability Director

You represent the interests of the Resilience Harbor Planning Department. It is your role to ensure the recommendations and decisions made ensure a safe, healthy, and sustainable path for Resilience Harbor to continue to grow and function in the face of future climate change.

Asset Condition Cards

Historic Courthouse

The Historic Courthouse is a registered landmark beloved by the community and frequently used for weddings. Because it is a historic structure, the building cannot be elevated or

Asset Condition Cards

Riverfront Estates

Originally settled in the 1890s by fishermen, the Estates neighborhood has tripled over the last two decades and now comprises 300 homes. Housing styles range from original Craftsmen to sprawling 1950s ranch homes to new, luxury vacation estates. This neighborhood is home to many wealthy residents. The Abundance River has overflowed its banks twice in the last decade, causing millions of dollars worth of damage.

Built gradually, 1890s-present.


Questions?